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Rev. 01

RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR THE DECONTAMINATION AND CLOSURE OF THE 183-H SOLAR EVAPORATION BASINS

Hanford Site,
Richland, Washington

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Richland, Washington

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DOE/RL-95-05
Rev. 01

Radioactive Air Emissions Notice of Construction for the Decontamination and Closure of the 183-H Solar Evaporation Basins

Hanford Site, Richland, Washington

Author
Joe M. Nickels

Date Published
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Department of Energy
P.O. Box 550
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Title of Document: RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR THE DECONTAMINATION AND CLOSURE OF THE 183-H SOLAR EVAPORATION BASINS

Author(s): Joe M. Nickels

Approval: B.W. Mathis, Manager Decommissioning Projects

B. W. Mathis
Signature

2/2/95
Date

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EXECUTIVE SUMMARY

A Notice of Construction (NOC) is required by the Washington State Department of Health (DOH) , pursuant to Washington Administrative Code (WAC) Chapter 246-247-060, for any proposed construction or modification of an existing registered or unregistered emissions unit. The following document is the NOC application to be submitted to the DOH for the establishment of decontamination and closure of the 183-H Basins at the 100-H Area on the Hanford Site. The decontamination will generate radioactive air emissions. This document was prepared in accordance with the application information requirements specified in Appendix A of WAC 246-247-110.

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APPENDICES

FIGURES

1.0 INTRODUCTION

This Notice of Construction (NOC) presents the proposed plans for the decontamination and closure of the 183-H Solar Evaporation Basins, located within 100-H Area of the Hanford Site. The basins will be closed in 1995, pursuant to the Resource Conservation and Recovery Act of 1976 (RCRA) as amended. The proposed action would encompass the following closure actions: (1) decontamination of the interior surface of the basins, (2) demolition of the decontaminated basin concrete, (3) analysis and disposal of both decontaminated concrete and waste generated during decontamination, (4) analysis of surface soil samples from beneath the basin floors and surrounding the outside basin perimeter to confirm clean closure, or to provide a basis for soil remediation; background soil samples will be collected for comparison with these soil samples and this will be followed by near-grade level soil remediation if necessary, and (5) contouring and re-vegetation of the land. Removal of the 183-H is necessary because the location would be included in the expected designation of the Hanford section of the Columbia River as a Wild and Scenic Riverway, under the jurisdiction of the National Park Service.

Cement dust containing small amounts of radionuclide particulates may be generated during decontamination and demolition of the 183-H Basin concrete. There will be no measurable toxic air pollutants. Samples of residual contamination and historical data indicate levels are extremely far below the small quantity emission rate tables for toxic air pollutants. No other measurable levels of airborne contaminants are expected to be produced as a result of such activities. Decontamination of the concrete surface will be accomplished by mechanical removal via a scabbling method.

"Response to Requirement" subtitle under each of the following sections identifies the corresponding Appendix A NOC application requirement listed under Washington Administrative Code (WAC) 246-247-110.

2.0 FACILITY LOCATION (Response to Requirement 1)

U.S. Department of Energy, Richland Operations Office
Hanford Site
100-H Area, 183-H Solar Evaporation Basins
Latitude: W. 39200 Longitude: N. 96400 (Hanford Coordinates)
Richland, Washington 99352

The 183-H Solar Evaporation Basins are located in the 100-H Area of the Hanford Site. The 100-H Area is located north in the Hanford Site along the Columbia River approximately 35 miles northwest of the city of Richland, Washington (Figure 2-1). The 100-H Area was in operation from October 1949 to April 1965. The 183-H Basins were originally designated as part of the 183-H Filter Plant that operated concurrently with the 100-H Reactor (Figure 2-2). The filter plant provided water treatment, filtering facilities, and reservoir capacity for the reactor process water system. The filter plant consisted of a head house and chemical building, 16 flocculation and sedimentation basins, filter building, and clearwell storage with a pump room. In the spring of 1974, after decontamination, demolition of the 183-H Filter Plant was initiated under the Hanford Site Housekeeping and Cleanup Program for the 100-H Area. The 183-H head house, 12 of the 16 flocculation and sedimentation basins, the filter building, and the clearwell pump room were demolished to ground level and the underground portions were backfilled to ground level. The clearwells were left intact for future use as a disposal site for clean debris. Radioactive waste underwent treatment by evaporation at this facility from 1973 to 1985. From 1986 through 1990, all bulk waste was removed from the basins. The basin concrete structures remain intact (Figure 2-3).

3.0 RESPONSIBLE MANAGER (Response to Requirement 2)

Responsible Manager:
Ms. J. K. Erickson, Director
River Sites Restoration Division PH: (509) 376-3603
U.S. Department of Energy, Richland Operations Office
P.O. Box 550
Richland, Washington 99352

4.0 TYPE OF PROPOSED ACTION (Response to Requirement 3)

The proposed action is considered a modification of the existing 183-H Solar Evaporation Basins, an interim status RCRA permitted Treatment, Storage and Disposal (TSD) Unit. The activities, consisting of decontamination and dismantlement of the basin concrete structures, would be part of the closure for this RCRA TSD unit. The basins are not associated with any registered emission units, in accordance with WAC 246-247.

5.0 STATE ENVIRONMENTAL POLICY ACT (Response to Requirement 4)

The closure of the 183-H Solar Evaporation Basins is categorically exempt from the State Environmental Policy Act checklist process by reference in WAC 246-03-020.

FIGURE 2-1 HANFORD SITE MAP

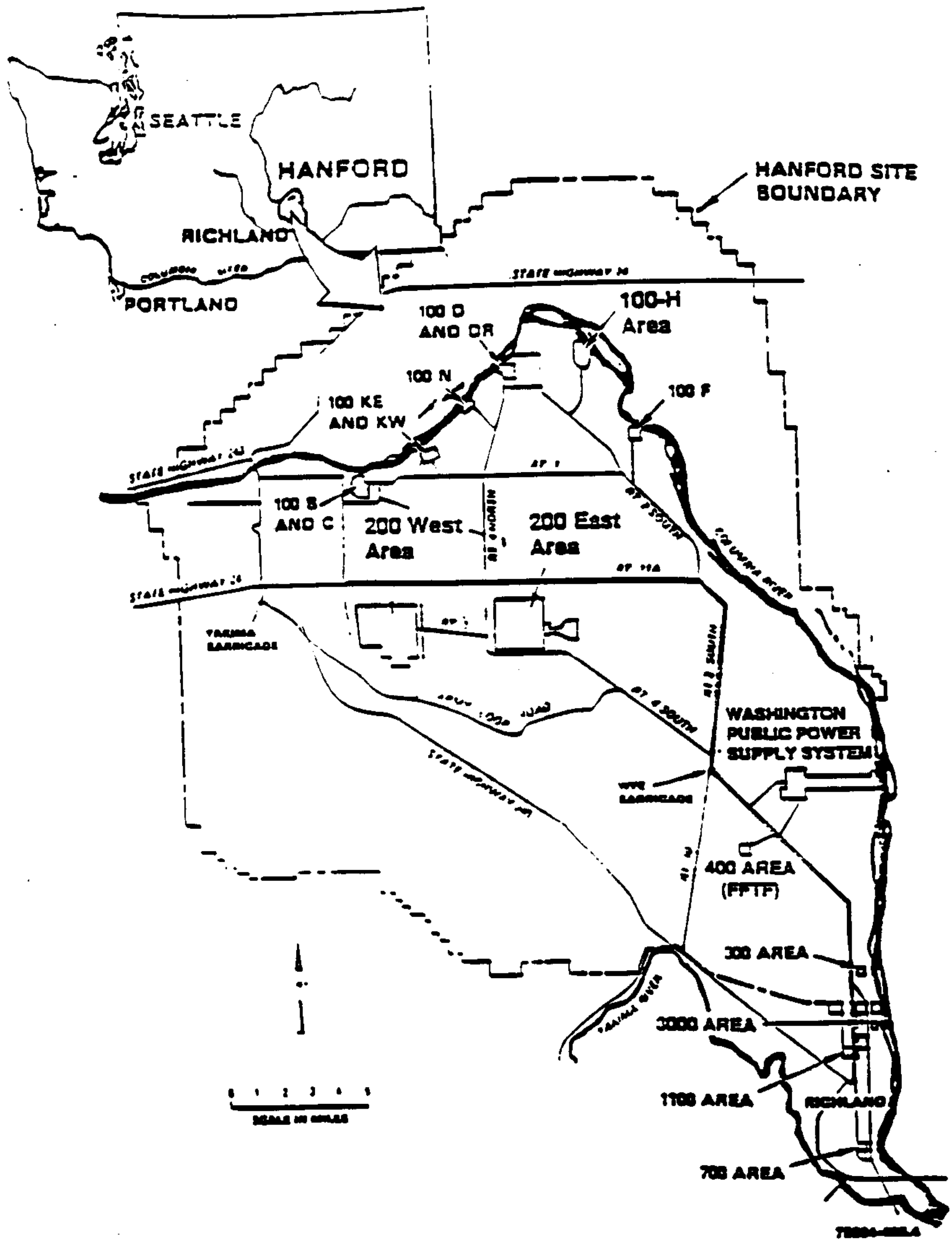


FIGURE 2-2 100 - H AREA MAP

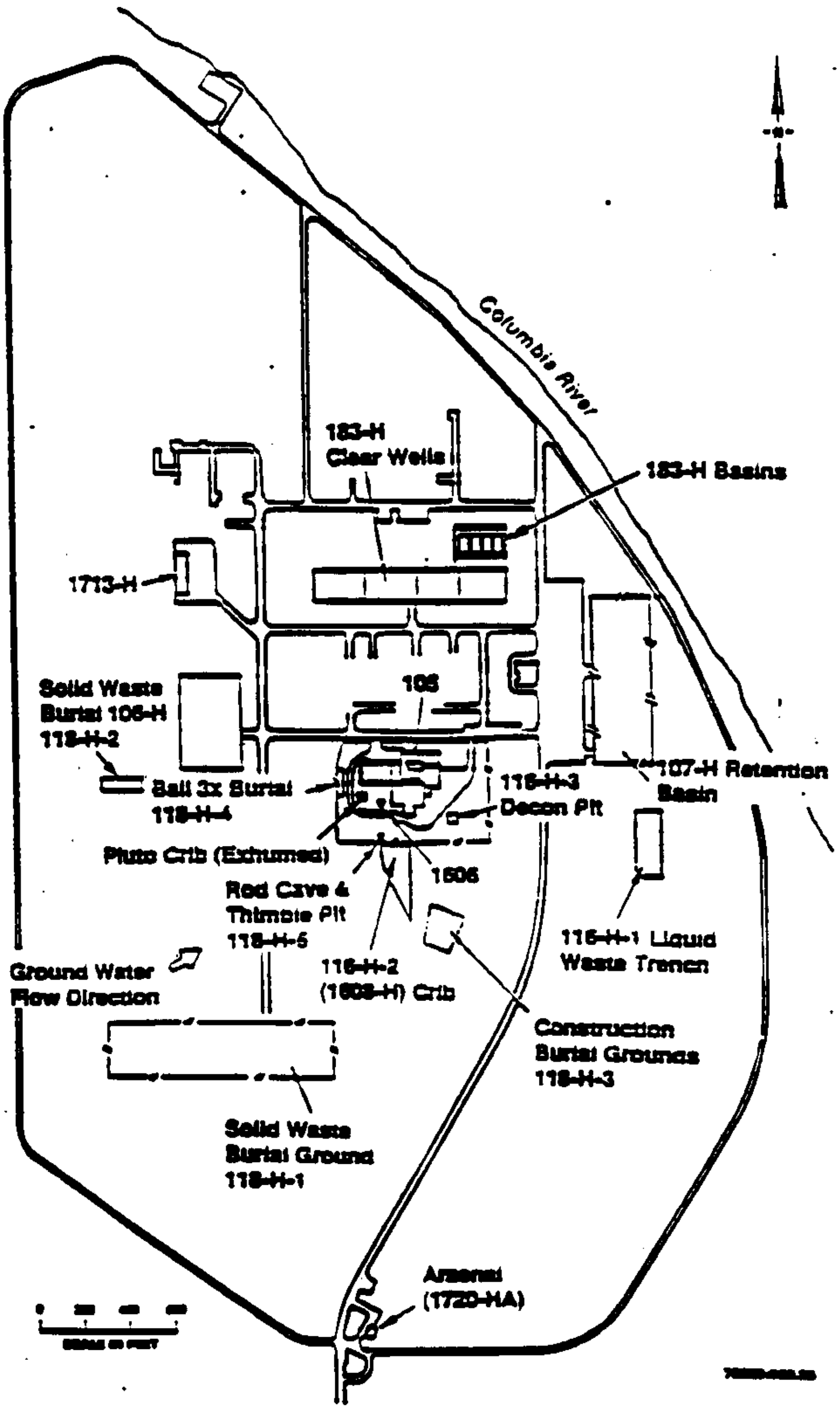
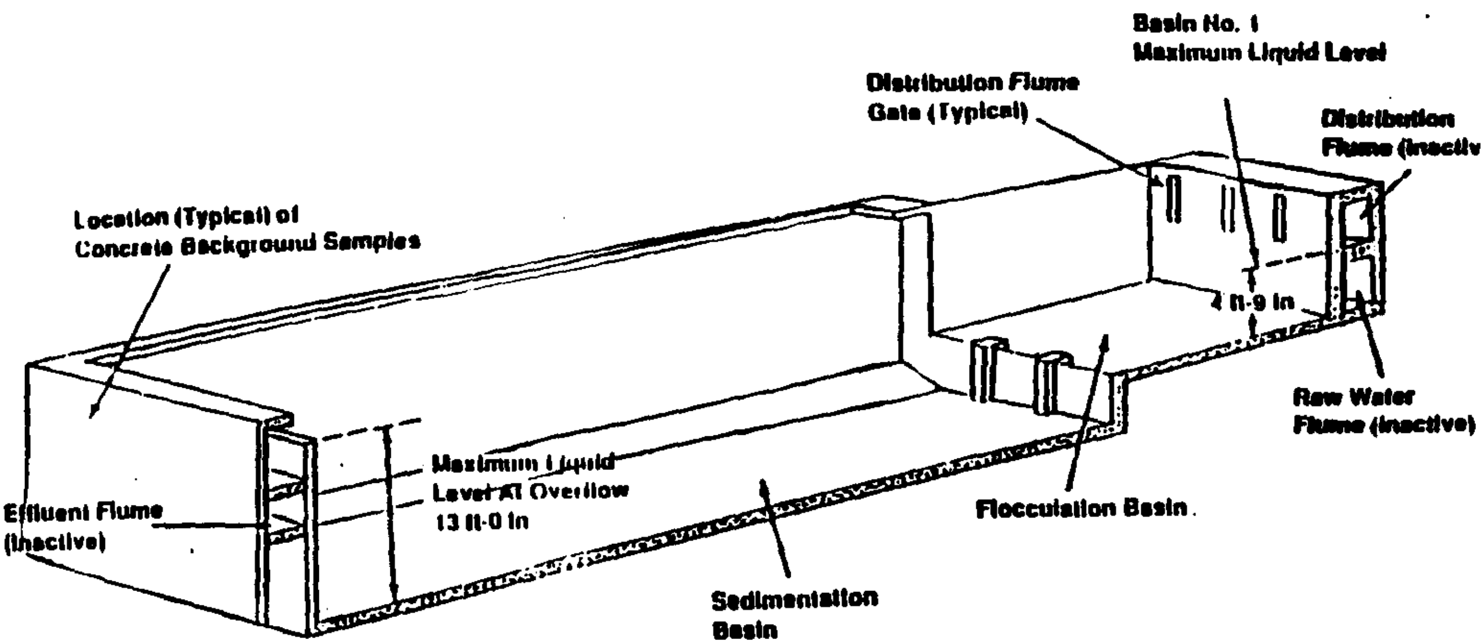


FIGURE 2-3 183-H BASIN (Typical)



78001-001.8

6.0 PROCESS DESCRIPTION (Response to Requirements 5 and 7)

The proposed decontamination and decommissioning (D&D) work will involve mechanically removing concrete and liner material from the interior basin surface to a depth of approximately 6 mm (0.24 in) (Figure 6-1). This type of removal method, called scabbling, is to be used as a decontamination method that will only be applied at and below the liquid levels where the radioactive contamination resides within the basins. The entire basin interior will not be scabbled.

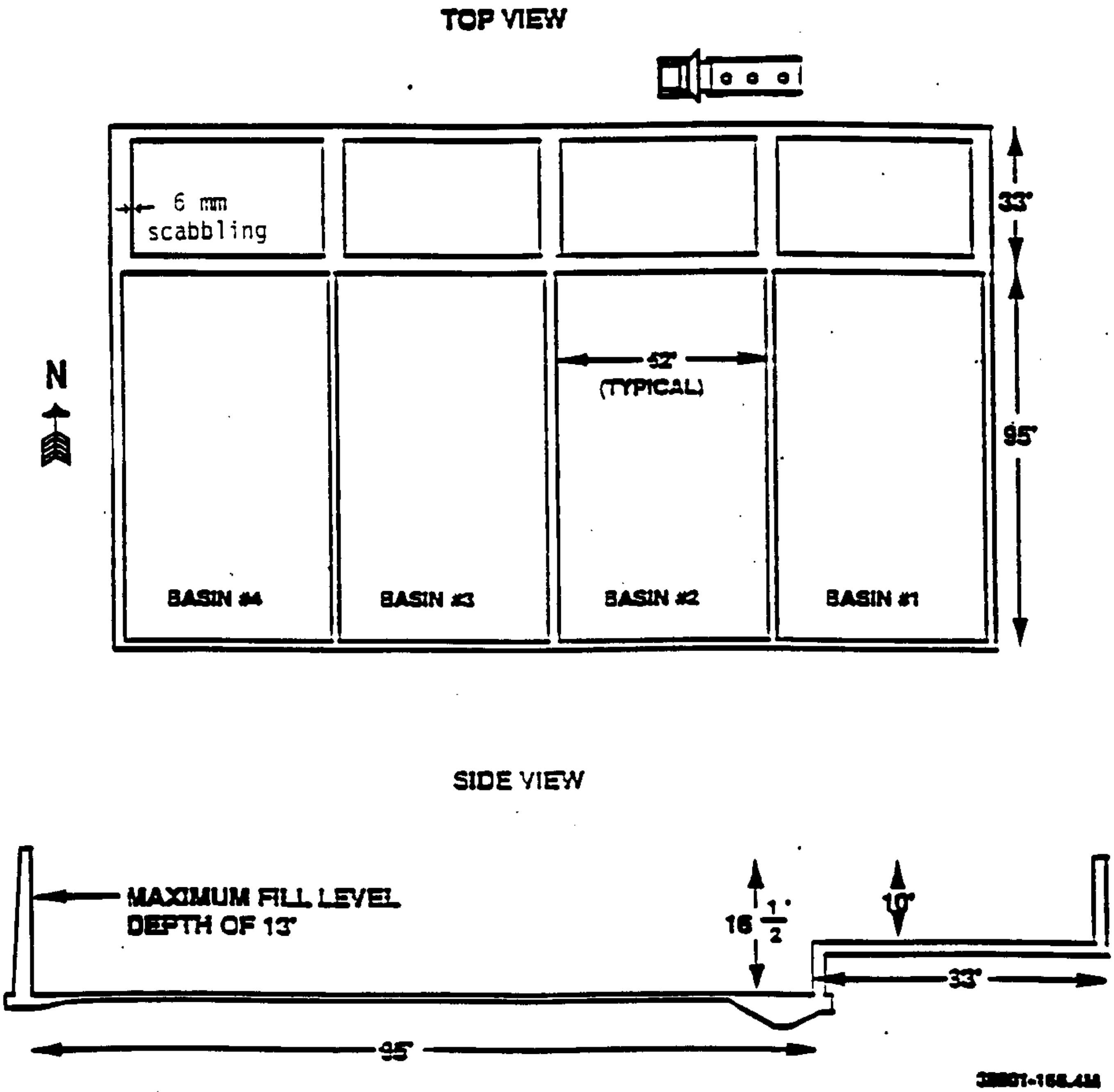
Several technologies have been proven effective for removing concrete surface layers. Decontamination of the concrete basin surfaces will be performed using dustless decontamination systems. These systems utilize proven components (such as sandblasting, needle guns, shot-peen systems, planing using diesel-powered machines, chemical dissolution, and carbon dioxide pelletization) fitted with vacuum shrouds that gather particulate contaminants utilizing HEPA-filtered vacuums (see Section 9.0). In the event that these systems do not remove all the contamination or contamination that exists in cracks deep in the concrete, these contaminant locations will be marked and fixed with fixative paint, removed and handled separately from the rest of the concrete during slab demolition/dismantlement.

Portable shot-peening or shot-blast machine is the preferred type of scabbling equipment that would be used. Vendors of this type of decontamination method will be solicited for the proposed activity. This type of abrasive blasting system is operated in conjunction with a vacuum system to reduce dust and to collect both the spent abrasive and the debris surface layer that is to be removed during operation. The shot-blast machine is electrically operated and travels on wheels across the surface to be decontaminated. A hardened steel shot propelled at a high rate of speed abrades the surface of the concrete. The depth of material removed is determined by the rate of speed the machine is traveling and the volume of shot being fed into the blast chamber. The steel shot is recycled and used over and over until it is pulverized into dust, which then ends up in the waste container with the concrete being removed. Particles released by this operation will be continually vacuumed by a large dust collection system attached to the unit which is high efficiency particulate air (HEPA) filtered as they are generated. This is a dry method of removal and only the material removed needs to be disposed of. A shot-peening system was demonstrated at Hanford on August 18, 1994 in the 300 Area of the Hanford Site. Based upon the demonstration using a similar system, the proposed decontamination will take place at a removal rate of approximately 37 square meters per hour (400 square feet per hour). The total estimated volume of surface material to be removed is 756 cubic feet. The decontamination process is expected to be performed in less than 120 calendar days.

Post radiological surveys will be performed to determine the conditions of the decontaminated and fixed contaminant areas to ensure no surface or unexpected contamination exists.

After the selection of the preferred method (shot peening), a post decontamination radiological survey will be conducted to determine the degree of decontamination attained. Any remaining areas of contamination will be fixed and removed using techniques such as wire cutting and concrete sawing. Temporary containment enclosures will be used, as required, to control dust resulting from the activities. Also dust suppression techniques may be employed with the use of any cutting equipment.

FIGURE 6-1 DIMENSIONS OF THE 183-H BASINS



A soil survey of the 183-H area will be performed after the basins are removed to identify any areas of contamination. If contaminated areas are identified, sampling and surveying efforts will be performed to determine the extent of contamination. Depending on the degree and extent of contamination, the site may be remediated in accordance with overall Hanford Site cleanup strategies, or the site will be covered with clean soil and re-vegetated.

7.0 ANNUAL POSSESSION QUANTITY AND PHYSICAL FORM (Response to Requirements 8,10, 11, and 12)

The facility chemical and radiochemical inventory has been removed from the basins. Only residual radioactive contamination is present in the basin concrete and surrounding soils. Samples were taken of the basin floor and analyzed October 1994. The analysis represents the average composition of the entire core. A factor of 25 was multiplied by the sample results to conservatively account for the entire core. The factor is derived by the 6mm scabble-depth divided by the total 6 inch core-depth. The data quality objectives for the sampling and characterization were based on waste disposal requirements provided in WHC-EP-0063, Rev. 4, *Hanford Site Solid Waste Acceptance Criteria* (WHC 1993). Radiological analysis techniques included total activity, gamma energy analysis, alpha energy analysis, and specific techniques to determine beta specific emitters and radium emitters. The radionuclides found were typical of past historical wastes previously found in the basins during operations.

Data from the basin samples was used in developing the source inventory. The total curie inventory for the radioisotopes present in the contaminated area was determined by multiplying the radionuclide activity found in the samples (curies per gram) by the volume (cubic meters) of contaminated material and the density of contaminated material (grams per cubic meter). The density of concrete (2.28E +04 grams per cubic meter) was used in the inventory calculations. The volume of contaminated basin concrete is 21.41 cubic meters (756 cubic feet). The approximate amount of concrete to be scabbled and removed is 6.10E +07 grams.

The radionuclide inventory for the contaminated area is presented below:

Radio-nuclide	Physical Form	Total Curies	Release Form	Solubility Class (ICRP 30)	Release Fraction	Annual Possession Quantity (Ci/yr)
Technetium-99	particulate solid	3.25E-01	particulate solid	D	1	3.25E-01
Uranium-234	particulate solid	7.00E-03	particulate solid	D	1	7.00E-03
Uranium-235	particulate solid	3.50E-04	particulate solid	D	1	3.50E-04
Uranium-236	particulate solid	6.25E-04	particulate solid	D	1	6.25E-04
Uranium-238	particulate solid	5.25E-03	particulate solid	D	1	5.25E-03

If airborne releases occur from the 183-H activities, they will be particulate; however, since decontamination methods will use a vacuum system, the release fraction for this permit application has been assumed conservatively to be "1" per direction provided by DOH (letter dated August 1, 1994, from A. W. Conklin to S. H. Wisness). Whether a release fraction of "1" (or some lesser fraction) is appropriate is still a subject of discussion with DOH.

8.0 CONTROL SYSTEM (Response to Requirement 6)

The following diagram represents the control technology configuration (Figure 8-1). The control efficiency and annual volumetric flow rate are identified on the diagram.

9.0 MONITORING SYSTEM (Response to Requirement 9)

A Euroclean model UZ948 (or similar) HEPA-filtered high performance, portable hazardous and radiological materials collection system will be used.

A dustless mechanical method utilizing vacuum shrouded needle guns, a vacuum shrouded floor shot peening will be used for the concrete decontamination. By connecting a HEPA-filtered vacuum system to the tool, the dust and debris can be collected into 55-gallon collection drums as it is generated.

The HEPA-filtered vacuum system shall have a minimum efficiency of 99.95% for the removal of airborne particulates. The basis for this is *The Nuclear Air Cleaning Handbook, Section 8.2 (ERDA 1976)*, which states that by definition, a HEPA system must exhibit an installed decontamination factor of 2,000 which is an efficiency of 99.95% for the removal of aerosols having a nominal median diameter of less than 1 micrometer (BHI 1994).

The potential unabated dose, 8.77E-02 mrem/yr (see Section 10.2), is not greater than 0.1 mrem/yr; therefore, this air emission source is not subject to the radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAP) for continuous monitoring systems as defined in 40 CFR 61.93(b). However, periodic confirmatory measurements will take place throughout the duration of the project.

10.0 RELEASE RATES (Response to Requirement 13)

10.1 Unabated Release Rate

This section provides information regarding the emission release rate from the decontamination and closure of the 183-H Solar Evaporation Basins without the emission control vacuum system in place. Also included is the effective dose equivalent (EDE) to the maximally exposed individual (MEI) offsite resulting from unabated emissions.

FIGURE 8-1 ROUGH SCHEMATIC OF SHOT BLASTING SYSTEM

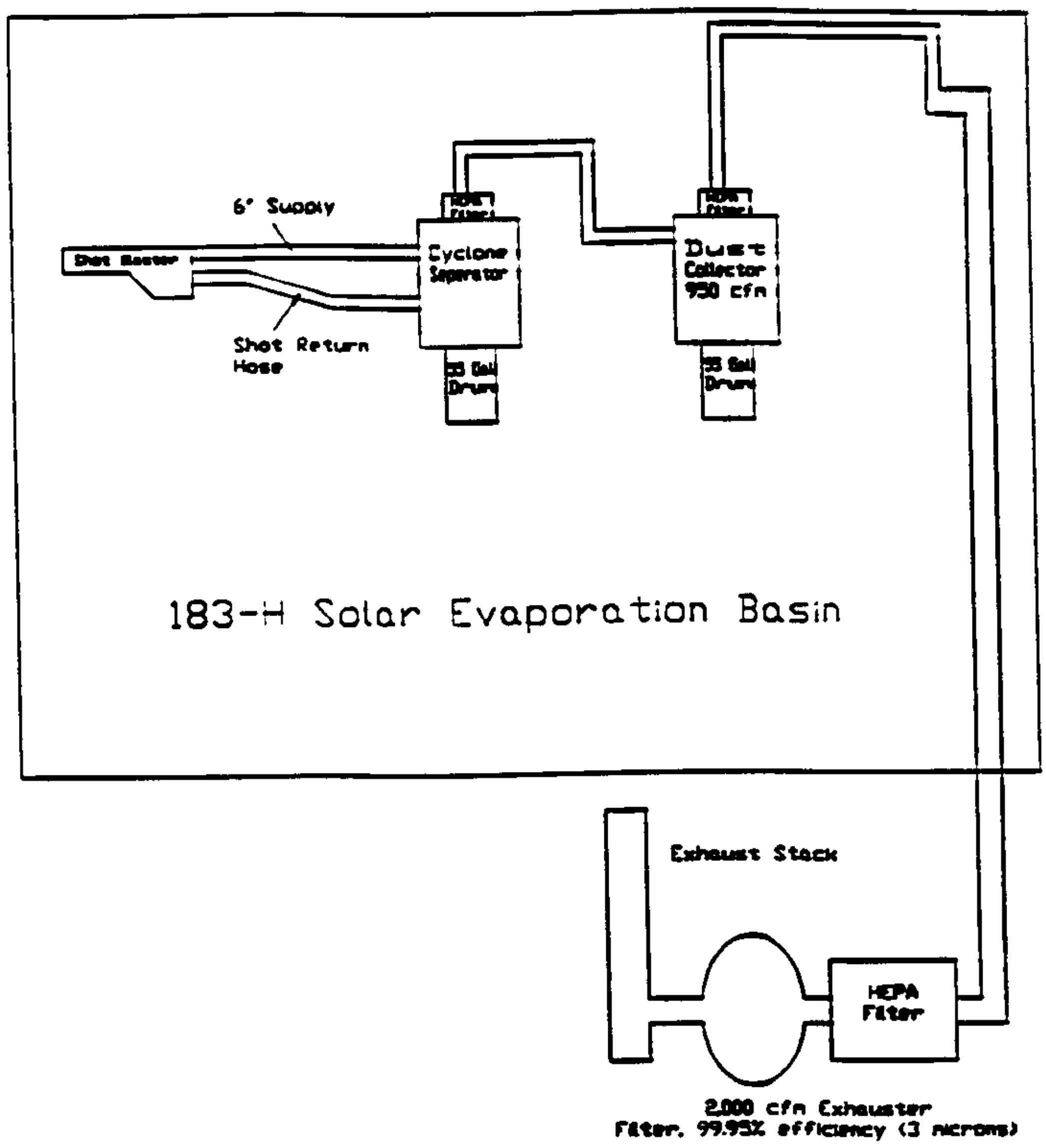


Figure 8-1. Rough Schematic of Shot Blasting Syster

10.2 Unabated Dose

A Clean Air Assessment Package 1988 (CAP-88) evaluation was run specifically for the projected releases from the 183-H Solar Evaporation Basins (Appendix B). Using the CAP-88 unit dose release factors for ground-level releases from the basins, the projected offsite unabated dose to the MEI is shown below.

Radionuclide	CAP-88 Unit Dose Factor (mrem/Ci)	Annual Unabated Emissions (Ci/yr)	Release Fraction	Annual Unabated Dose (mrem/yr)
Technetium-99	0.0367	3.25E-01	1	1.19E-02
Uranium-234	5.62	7.00E-03	1	3.93E-02
Uranium-235	5.32	3.50E-04	1	1.86E-03
Uranium-236	5.32	6.25E-04	1	3.33E-03
Uranium-238	5.97	5.25E-03	1	3.13E-02
			Total:	8.77E-02

10.3 Abated Release Rate

This section provides information regarding the emission release rates from the decontamination and closure of the 183-H Solar Evaporation Basins with the emission control vacuum system in place. Also included is the effective dose equivalent (EDE) to the maximally exposed individual (MEI) offsite resulting from abated emissions.

10.4 Abated Emissions

The following information below presents the abated emissions resulting from the decontamination and closure activities. Since HEPA filtration is the control system used, a removal efficiency of 99.95% can be applied to the unabated emissions to calculate the abated emissions (BHI 1994).

Radionuclide	Annual Unabated Emissions (Ci/yr)	Control Equipment Efficiency (%)	Annual Abated Emissions (Ci/yr)
Technetium-99	3.25E-01	99.95	1.63E-04
Uranium-234	7.00E-03	99.95	3.50E-06
Uranium-235	3.50E-04	99.95	1.75E-07
Uranium-236	6.25E-04	99.95	3.12E-07
Uranium-238	5.25E-03	99.95	2.63E-06

10.5 Abated Dose

The abated dose to the MEI, located 10.5 km east of the 183-H Solar Evaporation Basins is shown below. The projected EDE to the MEI from abated emissions is 1.80E -06 mrem/yr. The unit dose factors included in the table are described in Section 10.2.

The dose resulting from all Hanford Site operations in 1993 was determined to be 0.03 mrem/yr for an individual located at a farm on Sagemore Road, Riverview directly across the Columbia River from the site boundary to the east of the 300 Area (PNL 1994). The emissions as a result of the decontamination and closure of the 183-H Solar Evaporation Basins in conjunction with other operations at the Hanford Site will not result in a violation of the National Emission Standard of 10 mrem/yr.

Radionuclide	Annual Abated Emissions (Ci/yr)	CAP-88 Unit Dose Factor (mrem/yr)	Annual Abated Dose (mrem/yr)
Technetium-99	1.63E-04	0.0367	5.98E-06
Uranium-234	3.50E-06	5.62	1.97E-05
Uranium-235	1.75E-07	5.32	9.31E-07
Uranium-236	3.12E-07	5.32	1.66E-06
Uranium-238	2.63E-06	5.97	1.57E-05
		Total:	4.40E-05

11.0 OFFSITE IMPACT (Response to Requirements 14 and 15)

The total effective dose equivalent to the maximum exposed individual for abated emissions is 4.40E-05 mrem/yr and for unabated emissions is 8.77E-02 mrem/yr. Input data (i.e. distance, windrose data, meteorological conditions, etc.) used for the air transport calculations and CAP-88 results are presented in Appendix B.

12.0 COST FACTORS (Response to Requirement 16)

A BARCT assessment is provided in Appendix A. Appendix A represents the BARCT demonstration and is submitted with this NOC. As such, cost factors for construction, operation, and maintenance of the proposed control technology components and system are not required if a BARCT assessment is provided.

13.0 FACILITY LIFETIME (Response to Requirement 17)

The lifetime for closure of the 183-H Solar Evaporation Basins is 18 months. Final closure is scheduled for completion by the end of February 1996. The decontamination is scheduled for 120 days. Dismantlement of the basins also is scheduled for 120 days. The project manager would like to begin work in March 1995. The total emission rates during this activity are expected to not exceed the total potential unabated release rate of 3.38E-01 Ci/yr.

14.0 TECHNOLOGY STANDARDS (Response to Requirement 18)

Since EPA-compliant monitoring is not required for this activity and the potential unabated dose is less than 0.1 mrem/yr, application of ANSI N13.1 and 40 CFR 61 monitoring control methods will not be applied. Testing of the HEPA filters on the shot peening vacuum collection system will be performed in accordance with the intent of ASME/ANSI N509 and N510.

15.0 TOTAL PARTICULATES

The total abated particulates in air is 0.21 micrograms per cubic meter which is less than one pound per day. The activity per gram of concrete, exhaust volume per time, and the specific activity per radionuclide was used in the inventory calculation.

16.0 REFERENCES

BHI 1994, *Draft Environmental Requirements Manual,* BHI-EE-02, Bechtel Hanford Incorporated, Richland, Washington.

PNL 1994, *Hanford Site Environmental Report for Calendar Year 1993,* June 1994, PNL-9823, UC-602, Pacific Northwest Laboratory, Richland, Washington.

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APPENDIX A

BARCT/ALARACT Discussion

It is proposed that the HEPA-filtered high performance portable hazardous and radiological materials vacuum collection system as described in Sections 6.0 and 9.0 be approved as Best Available Radionuclide Control Technology (BARCT) for the decontamination and closure of the 183-H Solar Evaporation Basins. This discussion of BARCT does not present a detailed evaluation of all of the available radionuclide control technologies nor does it rank the relative benefits with respect to the environment, economical, and energy impacts of each technology. The DOH has provided guidance that HEPA filters are generally accepted as BARCT for particulate radionuclide air emissions. HEPA filtration systems are used extensively at the Hanford Site for the control of particulate radionuclide air emissions.

APPENDIX B

CAP-88 Unit Release Dose Factors for 100-H Area Annual Releases From Ground Level

DON'T SAY IT -- Write It!

November 9, 1994

To: Donald P. Butcher
H6-07 376-2606

From: Paul D. Rittmann
H6-30 376-8715

Subject: **CAP88PC Results for 183-H Annual Releases**

The CAP88PC Version 1.0 program from EPA Nevada was used along with Hanford Site wind data collected at the 100-N area from 1983 to 1991 to calculate unit release dose factors for annual, ground-level releases from the 183-H Solar Evaporation Basins. These dose factors are listed below.

Nuclide	mrem/Ci
K-40	0.204
Tc-99	0.0367
Ru-106	0.0284
Cs-137	0.268
U-234	5.62
U-235	5.32
U-236	5.32
U-238	5.97

The site boundary farmer who gets this dose is located 10.5 kilometers east of the 183-H basins.

Additional information is provided below. In particular, the distances to and integrated exposures at the site boundary in each of the 16 wind directions is given. In addition, the doses are compared with GENII Version 1.485.

Air Transport to the Hanford Site Boundary

Wind data collected in the 100-N Area at an elevation of 10 meters during the years 1983 to 1991 was used for the air transport calculations. No plume rise was included. The effective release height was 2 meters.

The table below shows the air transport information for both CAP88PC and GENII. The CAP88PC values divided by the GENII values are shown in the last column. The southerly transport directions show a marked difference due to the presence of high wind speeds. The crude method used by CAP88PC when it computes time-integrated exposure does not properly weight the high wind speed data. For our case, the site boundary to the east of 183-H has the highest integrated exposure and hence dose. CAP88PC is only 16 percent lower than GENII for this direction.

The distance shown for the east direction was increased from 10440 meters to 10500 meters for the remainder of the calculations. The additional 60 meters has an insignificant effect on the final doses.

Distances and Normalized Time-Integrated Exposures

Dir	Site Boundary meters	Normalized Integrated Exposure (sec/m³) CAP88PC	GENII	Ratio
S	35940	9.35E-09	1.66E-08	0.56
SSW	33520	7.38E-09	1.18E-08	0.63
SW	28500	8.48E-09	1.59E-08	0.53
WSW	21600	1.97E-08	2.89E-08	0.68
W	13210	7.67E-08	1.08E-07	0.71
WNW	11210	5.94E-08	8.44E-08	0.70
NW	10220	5.45E-08	7.82E-08	0.70
NNW	10260	3.77E-08	5.43E-08	0.70
N	10190	4.62E-08	6.96E-08	0.66
NNE	10070	3.94E-08	5.78E-08	0.68
NE	9840	6.13E-08	8.78E-08	0.70
ENE	9960	1.01E-07	1.38E-07	0.73
E	**10440**	**1.57E-07**	**2.12E-07**	**0.74**
ESE	11440	7.96E-08	1.13E-07	0.70
SE	14440	4.03E-08	6.09E-08	0.66
SSE	31690	8.64E-09	1.78E-08	0.49

Directions shown are the transport directions away from 183-H.

<u>Site Boundary Dose Comparison</u>

The CAP88PC dose results for the nuclides of interest are shown in the table below. Food is assumed to be locally grown. The CAP88PC default parameters are used. The SUMMARY and SYNOPSIS files generated for this run are attached. Additional CAP88PC runs were done to determine the inhalation, ingestion and external doses shown on the table.

CAP88PC Unit Release Dose Factors, mrem/yr per curie released

Nuclide	Inhale	Ingest	External	Total
K-40	5.06E-04	1.14E-01	8.92E-02	0.204
Tc-99	3.32E-04	3.64E-02	3.95E-07	0.0367
Ru-106	1.89E-02	9.50E-03	2.84E-24	0.0284

Cs-137	1.23E-03	6.07E-02	2.06E-01	0.268
U-234	5.23E+00	3.86E-01	5.24E-04	5.62
U-235	4.84E+00	3.69E-01	1.10E-01	5.32
U-236	4.95E+00	3.65E-01	4.76E-04	5.32
U-238	4.65E+00	3.50E-01	9.63E-01	5.97

For comparison, the GENII program, Version 1.485, was used with its default parameters to compute a chronic dose from each nuclide. The integrated exposure for 10.5 Km east (1.55E-07 sec/m³ from CAP88PC) was used in the GENII run. The input data file is attached for reference. The dose results are shown below. While CAP88PC gives results with three significant figures, GENII only provides two.

GENII Unit Release Dose Factors, mrem/yr per curie released

Nuclide	Inhale	Ingest	External	Total
K-40	5.0E-04	1.8E-02	2.4E-04	0.018
Tc-99	3.8E-04	6.3E-03	2.1E-08	0.0066
Ru-106	2.0E-02	7.0E-03	3.2E-04	0.027
Cs-137	1.3E-03	4.2E-02	1.1E-03	0.044
U-234	5.6E+00	7.6E-02	1.1E-07	5.7
U-235	5.2E+00	7.1E-02	8.6E-06	5.3
U-236	5.3E+00	7.2E-02	6.0E-08	5.4
U-238	5.0E+00	7.3E-02	4.4E-05	5.0

The CAP88PC and GENII results were compared by taking the CAP88PC doses and dividing them by the GENII doses. These ratios are shown in the table below.

CAP88PC Doses Divided by GENII Doses

Nuclide	Inhale	Ingest	External	Total
K-40	1.01	6.33	372	11.33
Tc-99	0.87	5.78	19	5.56
Ru-106	0.95	1.36	8.9E-21	1.05
Cs-137	0.95	1.45	187	6.09
U-234	0.93	5.08	4,760	0.99
U-235	0.93	5.20	12,790	1.00
U-236	0.93	5.07	7,930	0.99
U-238	0.93	4.79	21,900	1.19

The inhalation doses are fairly close. The CAP88PC ingestion doses are larger due to the default parameter selection. The CAP88PC external doses are radically different from GENII due to the peculiar models used in CAP88PC. The Ru-106 external dose is near zero in CAP88PC because the program does not include the ingrowth of Rh-106, which has a 30 second halflife.

CAP88PC SUMMARY FILE:

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Nov 9, 1994 12:20 am

Facility: 100H Area - Ground Level - Individual Nuclides
Address: Westinghouse Hanford Company
P.O. Box 1970
City: Richland
State: WA Zip: 99352-1970

Source Category:
Source Type: Stack
Emission Year: 1994

Comments: MI location is correctly selected by CAP88PC
Wind data generated at 100N from 1983 to 1991

Dataset Name: 100-H Area
Dataset Date: Nov 9, 1994 12:20 am
Wind File: WNDFILES\JF10010.WND

Nov 9, 1994 12:20 am SUMMARY
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ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem/y)
GONADS	1.86E+00
BREAST	1.78E+00
R MAR	3.32E+00
LUNGS	2.09E+02
THYROID	1.93E+00
ENDOST	3.08E+01
RMNDR	4.04E+00
EFFEC	2.84E+01

Radon Decay Product Concentration (working level)

0.00E+00

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Pathway	Selected Individual (mrem/y)
INGESTION	2.08E+00
INHALATION	2.49E+01
AIR IMMERSION	8.21E-06

GROUND SURFACE	1.37E+00
INTERNAL	2.70E+01
EXTERNAL	1.37E+00
TOTAL	2.84E+01

Radon Decay Product Concentration (working level)

0.00E+00

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NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Nuclide	Selected Individual (mrem/y)
K-40	2.04E-01
TC-99	3.67E-02
RU-106	2.84E-02
RH-106	2.90E-24
CS-137	6.19E-02
BA-137M	2.06E-01
U-234	5.62E+00
U-235	5.32E+00
TH-231	3.86E-05
U-236	5.32E+00
U-238	5.00E+00
TH-234	3.52E-03
PA-234	9.62E-01
U-234	5.62E+00
TH-230	0.00E+00
RA-226	0.00E+00
RN-222	0.00E+00
PO-218	0.00E+00
PB-214	0.00E+00
BI-214	0.00E+00
PO-214	0.00E+00
PB-210	0.00E+00
BI-210	0.00E+00
PO-210	0.00E+00
TOTAL	2.84E+01

Radon Decay Product Concentration (working level)

0.00E+00

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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	6.41E-06
BONE	1.84E-06
THYROID	8.57E-07
BREAST	6.81E-06
LUNG	3.41E-04
STOMACH	5.14E-06
BOWEL	2.35E-06
LIVER	4.67E-06
PANCREAS	2.87E-06
URINARY	7.19E-06
OTHER	3.51E-06
TOTAL	3.82E-04

	Selected Individual Cancer Risk
Radon Decay Product Lung Exposure	0.00E+00
Total Fatal Risk All Exposures	3.82E-04

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PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.56E-05
INHALATION	3.34E-04
AIR IMMERSION	1.94E-10
GROUND SURFACE	3.27E-05
INTERNAL	3.50E-04
EXTERNAL	3.27E-05
TOTAL	3.82E-04

	Selected Individual Cancer Risk
Radon Decay Product Lung Exposure	0.00E+00
Total Fatal Risk All Exposures	3.82E-04

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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
K-40	5.16E-06
TC-99	1.34E-06
RU-106	1.28E-06
RH-106	6.97E-29
CS-137	1.62E-06
BA-137M	4.94E-06
U-234	7.17E-05
U-235	6.92E-05
TH-231	1.13E-09
U-236	6.79E-05
U-238	6.44E-05
TH-234	1.06E-07
PA-234	2.30E-05
U-234	7.17E-05
TH-230	0.00E+00
RA-226	0.00E+00
RN-222	0.00E+00
PO-218	0.00E+00
PB-214	0.00E+00
BI-214	0.00E+00
PO-214	0.00E+00
PB-210	0.00E+00
BI-210	0.00E+00
PO-210	0.00E+00
TOTAL	3.82E-04

Selected Individual
Cancer Risk

Radon Decay Product Lung Exposure	0.00E+00
Total Fatal Risk All Exposures	3.82E-04

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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	10500
N	8.1E+00
NNW	6.7E+00
NW	9.6E+00
WNW	1.2E+01
W	1.9E+01
WSW	9.8E+00
SW	7.5E+00
SSW	7.5E+00
S	1.1E+01
SSE	9.1E+00
SE	1.1E+01
ESE	1.6E+01
E	2.8E+01
ENE	1.7E+01
NE	1.0E+01
NNE	6.8E+00

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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)
Direction	10500
N	1.1E-04
NNW	9.0E-05
NW	1.3E-04
WNW	1.6E-04
W	2.5E-04
WSW	1.3E-04
SW	1.0E-04
SSW	1.0E-04
S	1.5E-04
SSE	1.2E-04
SE	1.5E-04
ESE	2.2E-04
E	3.8E-04
ENE	2.3E-04
NE	1.4E-04
NNE	9.2E-05

CAP88PC SYNOPSIS FILE:

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Nov 9, 1994 12:20 am

Facility: 100H Area - Ground Level - Individual Nuclides
Address: Westinghouse Hanford Company
P.O. Box 1970
City: Richland
State: WA Zip: 99352-1970

Effective Dose Equivalent
(mrem/year)

2.84E+01

At This Location: 10500 Meters East

Source Category:

Source Type: Stack
Emission Year: 1994

Comments: MI location is correctly selected by CAP88PC
Wind data generated at 100N from 1983 to 1991

Dataset Name: 100-H Area
Dataset Date: Nov 9, 1994 12:20 am
Wind File: WNDFILES\JF10010.WND

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MAXIMALLY EXPOSED INDIVIDUAL
(RN-222 Working Level Calculations Excluded)

Location Of The Individual: 10500 Meters East
Lifetime Fatal Cancer Risk: 3.82E-04

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem/y)
GONADS	1.86E+00
BREAST	1.78E+00
R MAR	3.32E+00
LUNGS	2.09E+02
THYROID	1.93E+00
ENDOST	3.08E+01
RMNDR	4.04E+00
EFFEC	2.84E+01

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RADIONUCLIDE EMISSIONS DURING THE YEAR 1994

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
K-40	D	1.00	1.0E+00	1.0E+00
TC-99	W	1.00	1.0E+00	1.0E+00
RU-106	Y	1.00	1.0E+00	1.0E+00
RH-106	Y	1.00	1.0E+00	1.0E+00
CS-137	D	1.00	1.0E+00	1.0E+00
BA-137M	D	1.00	9.5E-01	9.5E-01
U-234	Y	1.00	1.0E+00	1.0E+00
U-235	Y	1.00	1.0E+00	1.0E+00
TH-231	Y	1.00	1.0E+00	1.0E+00
U-236	Y	1.00	1.0E+00	1.0E+00
U-238	Y	1.00	1.0E+00	1.0E+00
TH-234	Y	1.00	1.0E+00	1.0E+00
PA-234	Y	1.00	1.6E-03	1.6E-03
U-234	Y	1.00	1.0E+00	1.0E+00
TH-230	Y	1.00	0.0E+00	0.0E+00
RA-226	W	1.00	0.0E+00	0.0E+00
RN-222	*	0.00	0.0E+00	0.0E+00
PO-218	W	1.00	0.0E+00	0.0E+00
PB-214	D	1.00	0.0E+00	0.0E+00
BI-214	W	1.00	0.0E+00	0.0E+00
PO-214	W	1.00	0.0E+00	0.0E+00
PB-210	D	1.00	0.0E+00	0.0E+00
BI-210	W	1.00	0.0E+00	0.0E+00
PO-210	W	1.00	0.0E+00	0.0E+00

SITE INFORMATION

Temperature: 12 degrees C
Precipitation: 16 cm/y
Mixing Height: 1000 m

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SOURCE INFORMATION

Source Number: 1

Stack Height (m): 2.00
Diameter (m): 2.50

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.000	1.000	1.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

10500

GENII Input File:

```
######################### Program GENII Input File ########### 8 Jul 88 ####
Title: 183-H Solar Basin Dose Factors Using CAP88PC X/Q
   \183H2.IN                    Created on 11-04-1994 at 07:30
OPTIONS========================= Default ==================================
F  Near-field scenario?   (Far-field)  NEAR-FIELD: narrowly-focused
F  Population dose?       (Individual)         release, single site
F  Acute release?         (Chronic)   FAR-FIELD:  wide-scale release,
   Maximum Individual data set used                multiple sites
                 Complete                  Complete
TRANSPORT OPTIONS============ Section  EXPOSURE PATHWAY OPTIONS===== Section
T Air Transport              1  F Finite plume, external      5
F Surface Water Transport     2  T Infinite plume, external    5
F Biotic Transport (near-field) 3,4  T Ground, external         5
F Waste Form Degradation (near) 3,4  F Recreation, external      5
                       T Inhalation uptake          5,6
REPORT OPTIONS====================  F Drinking water ingestion    7,8
T Report AEDE only             F Aquatic foods ingestion    7,8
T Report by radionuclide       T Terrestrial foods ingestion 7,9
T Report by exposure pathway      T Animal product ingestion    7,10
F Debug report on screen       T Inadvertent soil ingestion

INVENTORY ##################################################################

4  Inventory input activity units: (1-pCi 2-uCi 3-mCi 4-Ci 5-Bq)
0  Surface soil source units (1- m² 2- m3 3- kg)
   Equilibrium question goes here

   --------|----Release Terms------|----------Basic Concentrations---------|
   Use when| transport selected   | near-field scenario, optionally     |
   --------|----------------------|-------------------------------------|
   Release |    Surface Buried |    Surface Deep   Ground  Surface|
   Radio-  |Air   Water  Waste |Air    Soil   Soil    Water   Water |
   nuclide |/yr   /yr    /m3   |/m3    /unit  /m3     /L      /L    |
   --------|------- ------- -------|------- ------- ------- ------- -------|
   K 40    1.0E+00
   TC99    1.0E+00
   RU106   1.0E+00
   CS137   1.0E+00
   U 234   1.0E+00
   U 235   1.0E+00
   TH231   1.0E+00
   U 236   1.0E+00
   U 238   1.0E+00
   TH234   1.0E+00
   PA234   1.6E-03

   --------|----Derived Concentrations-----|
   Use when|  measured values are known  |
   --------|-----------------------------|
   Release |Terres. Animal  Drink  Aquatic|
   Radio-  |Plant  Product Water  Food   |
   nuclide |/kg    /kg     /L     /kg    |
```

--------|-------- -------- -------- --------|

TIME ##

1 Intake ends after (yr)
50 Dose calc. ends after (yr)
1 Release ends after (yr)
0 No. of years of air deposition prior to the intake period
0 No. of years of irrigation water deposition prior to the intake period

FAR-FIELD SCENARIOS (IF POPULATION DOSE) ###

0 Definition option: 1-Use population grid in file POP.IN
0 2-Use total entered on this line

NEAR-FIELD SCENARIOS ##

Prior to the beginning of the intake period: (yr)
0 When was the inventory disposed? (Package degradation starts)
0 When was LOIC? (Biotic transport starts)
0 Fraction of roots in upper soil (top 15 cm)
0 Fraction of roots in deep soil
0 Manual redistribution: deep soil/surface soil dilution factor
0 Source area for external dose modification factor (m^2)

```
TRANSPORT ##########################################################################
      ====AIR TRANSPORT====================================================SECTION 1=====
          0-Calculate PM          |0      Release type (0-3)
1       Option: 1-Use chi/Q or PM value  |F      Stack release (T/F)
          2-Select MI dist & dir   |0      Stack height (m)
          3-Specify MI dist & dir  |0      Stack flow (m3/sec)
1.55E-07  Chi/Q or PM value            |0      Stack radius (m)
13        MI sector index (1=S)        |0      Effluent temp. (C)
10500.0   MI distance from release point (m)|0   Building x-section (m²)
F         Use jf data, (T/F) else chi/Q grid|0   Building height (m)

      ====SURFACE WATER TRANSPORT==========================================SECTION 2=====
0       Mixing ratio model: 0-use value, 1-river, 2-lake
0       Mixing ratio, dimensionless
0       Average river flow rate for: MIXFLG=0 (m3/s), MIXFLG=1,2 (m/s),
0       Transit time to irrigation withdrawl location (hr)
        If mixing ratio model > 0:
0         Rate of effluent discharge to receiving water body (m3/s)
0         Longshore distance from release point to usage location (m)
0         Offshore distance to the water intake (m)
0         Average water depth in surface water body (m)
0         Average river width (m), MIXFLG=1 only
0         Depth of effluent discharge point to surface water (m), lake only

      ====WASTE FORM AVAILABILITY==========================================SECTION 3=====
0       Waste form/package half life, (yr)
0       Waste thickness, (m)
0       Depth of soil overburden, m

      ====BIOTIC TRANSPORT OF BURIED SOURCE================================SECTION 4=====
T       Consider during inventory decay/buildup period (T/F)?
T       Consider during intake period (T/F)?  | 1-Arid non agricultural
0       Pre-Intake site condition..............| 2-Humid non agricultural
                                              | 3-Agricultural

EXPOSURE ###########################################################################

      ====EXTERNAL EXPOSURE================================================SECTION 5=====
      Exposure time:             |  Residential irrigation:
8766.0    Plume (hr)             | T     Consider: (T/F)
4380.0    Soil contamination (hr)  | 0    Source: 1-ground water
0         Swimming (hr)          |             2-surface water
0         Boating (hr)           | 0     Application rate (in/yr)
0         Shoreline activities (hr) | 0   Duration (mo/yr)
0       Shoreline type: (1-river, 2-lake, 3-ocean, 4-tidal basin)
0       Transit time for release to reach aquatic recreation (hr)
0       Average fraction of time submersed in acute cloud (hr/person hr)

      ====INHALATION=======================================================SECTION 6=====
8766.0  Hours of exposure to contamination per year
1       0-No resus-  1-Use Mass Loading        2-Use Anspaugh model
0.0001      pension   Mass loading factor (g/m3)  Top soil available (cm)
```

```
===INGESTION POPULATION=============================SECTION 7=====
  1    Atmospheric production definition (select option):
 0       0-Use food-weighted chi/Q, (food-sec/m3), enter value on this line
         1-Use population-weighted chi/Q
         2-Use uniform production
         3-Use chi/Q and production grids (PRODUCTION will be overridden)
 0     Population ingesting aquatic foods, 0 defaults to total (person)
 0     Population ingesting drinking water, 0 defaults to total (person)
 F     Consider dose from food exported out of region (default=F)
```

```
Note below: S* or Source: 0-none, 1-ground water, 2-surface water
            3-Derived concentration entered above
=== AQUATIC FOODS / DRINKING WATER INGESTION========SECTION 8====

F    Salt water? (default is fresh)

USE      TRAN- PROD-  -CONSUMPTION- |
?  FOOD  SIT   UCTION  HOLDUP  RATE |
T/F TYPE  hr   kg/yr   da    kg/yr |  DRINKING WATER
--- ------ ----- ------- ------ ----- |-----------------------
F  FISH    0.00 0.0E+00   0.00   0.0 | 0    Source (see above)
F  MOLLUS  0.00 0.0E+00   0.00   0.0 | T    Treatment? T/F
F  CRUSTA  0.00 0.0E+00   0.00   0.0 | 0    Holdup/transit(da)
F  PLANTS  0.00 0.0E+00   0.00   0.0 | 0    Consumption (L/yr)

===TERRESTRIAL FOOD INGESTION=====================SECTION 9====

USE      GROW  --IRRIGATION--      PROD-  --CONSUMPTION--
?  FOOD  TIME  S RATE  TIME  YIELD  UCTION  HOLDUP  RATE
T/F TYPE  da   * in/yr mo/yr kg/m²  kg/yr   da     kg/yr
--- ------ ----- - ----- ----- ----- ------- ------ ------
T  LEAF V 90.00 0  0.0  0.0   1.5  0.0E+00    1.0   30.0
T  ROOT V 90.00 0  0.0  0.0   4.0  0.0E+00    5.0  220.0
T  FRUIT  90.00 0  0.0  0.0   2.0  0.0E+00    5.0  330.0
T  GRAIN  90.00 0  0.0  0.0   0.8  0.0E+00  180.0   80.0

===ANIMAL PRODUCTION CONSUMPTION==================SECTION 10===

    ---HUMAN---- TOTAL  DRINK  ------------STORED FEED-------------
USE     CONSUMPTION PROD-  WATER  DIET GROW -IRRIGATION--    STOR-
?  FOOD  RATE HOLDUP UCTION CONTAM FRAC- TIME S RATE TIME  YIELD AGE
T/F TYPE  kg/yr  da   kg/yr FRACT.  TION  da  * in/yr mo/yr kg/m3 da
--- ------ ------ ----- ------ ------- ---- ---- - ----- ----- ----- -----
T  BEEF    80.0 15.0  0.00   0.00 0.25 90.0 0  0.0 0.00  0.80 180.0
T  POULTR  18.0  1.0  0.00   0.00 1.00 90.0 0  0.0 0.00  0.80 180.0
T  MILK   270.0  1.0  0.00   0.00 0.25 45.0 0  0.0 0.00  2.00 100.0
T  EGG     30.0  1.0  0.00   0.00 1.00 90.0 0  0.0 0.00  0.80 180.0
                          ------------FRESH FORAGE-----------
   BEEF                        0.75 45.0 0  0.0 0.00  2.00 100.0
   MILK                        0.75 30.0 0  0.0 0.00  1.50   0.0

###############################################################################
```